



U.S. Department  
of Transportation  
**Research and  
Special Programs  
Administration**

400 Seventh St., S.W.  
Washington, D.C. 20590

Mr. Jerald S. Burkett  
President  
BAC Technologies, Ltd.  
8115 Calland Road  
West Liberty, OH 43357-9604

AUG 18 2000

Dear Mr. Burkett:

Enclosed please find exemption DOT-E 12350 which authorizes the manufacture, marking, sale, and use of non-DOT specification fiber reinforced plastic (FRP) full composite (FC) aluminum cylinders for the transportation in commerce of certain compressed gases. These cylinders essentially conform to the DOT FRP-1 Standard.

Your application was well thought-out and comprehensive and we appreciate the clarity of your presentation. You made three requests that deviate from the DOT FRP-1 Standard and differ from similar composite cylinder exemptions:

- (1) An extended service life of 30 to 75 years, in lieu of 15 years;
- (2) A requalification interval of five years in lieu of three years;
- (3) A permanent volumetric expansion of 10% of the total expansion in lieu of 5%.

While the analysis submitted with your application appears to support a service life for the proposed cylinder design of 30 years or more, we are not prepared to recognize an extended life until sufficient experience is obtained to confirm your analysis. Therefore, the enclosed exemption requires BAC to carry out your proposed in-service testing program and submit the results to the Office of Hazardous Materials Exemptions & Approvals (OHMEA). After receipt of 10 year data from year 1 and 2 production, the Office of Hazardous Materials Technology (OHMT) will review the results and determine if the data validate your service life analysis. If the data validate your analysis and no other detrimental factors are identified, we will consider granting an extension of service life at that time. Based on a review of the justification submitted with your application, your request for a five-year retest interval has been granted.

As you discussed with Cheryl W. Freeman, the OHMT considers elastic volumetric expansion a better indication of the condition of the composite cylinder at the time of regualification. For this reason, your request for 10% permanent expansion has not been granted, and the requirement for elastic expansion not greater than the reject elastic expansion (REE) has been added to your exemption.

If you have further questions, please contact Cheryl West Freeman at (202)366-4545.

Sincerely,

A handwritten signature in dark ink, appearing to read "Robert A. McGuire", written in a cursive style.

Robert A. McGuire  
Associate Administrator for  
Hazardous Material Safety



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DOT-E 12350

EXPIRATION DATE: June 30, 2002

(FOR RENEWAL, SEE 49 CFR § 107.109)

1. GRANTEE: BAC Technologies, Ltd.  
West Liberty, Ohio
2. PURPOSE AND LIMITATION:
  - a. This exemption authorizes the manufacture, marking, sale and use of non-DOT specification fiber reinforced plastic (FRP) full composite (FC) cylinders for the transportation in commerce of certain compressed gases. This exemption provides no relief from the Hazardous Materials Regulations (HMR) other than as specifically stated herein.
  - b. The safety analyses performed in development of this exemption only considered the hazards and risks associated with transportation in commerce. The safety analyses did not consider the hazards and risks associated with consumer use, use as a component of a transport vehicle or other device, or other uses not associated with transportation in commerce.
3. REGULATORY SYSTEM AFFECTED: 49 CFR Parts 106, 107 and 171-180.
4. REGULATIONS FROM WHICH EXEMPTED: 49 CFR §§ 173.34, 173.302(a), 173.304(a), and 175.3 in that the prescribed packaging is not authorized therein.

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5. BASIS: This exemption is based on the application of BAC Technologies Ltd. dated August 25, 1999, and additional information dated April 17, June 6 and June 21, 2000, submitted in accordance with § 107.105 and the public proceeding thereon.
6. HAZARDOUS MATERIALS (49 CFR § 172.101):

Proper Shipping Name/ Hazardous Materials Description	Hazard Class/ Division	Identification Number	Packing Group
Air compressed (containing up to 39% by volume oxygen)	2.2	UN1002	N/A
Argon, compressed	2.2	UN1006	N/A
Carbon dioxide	2.2	UN1013	N/A
Helium, compressed	2.2	UN1046	N/A
Neon, compressed	2.2	UN1065	N/A
Nitrogen, compressed	2.2	UN1066	N/A
Nitrous oxide, compressed	2.2	UN1070	N/A
Oxygen, compressed	2.2	UN1072	N/A
Natural gas, compressed (Methane)	2.1	UN1971	N/A
Methane, compressed	2.1	UN1971	N/A
Hydrogen, compressed	2.1	UN1049	N/A

7. SAFETY CONTROL MEASURES:

a. PACKAGING - Packaging prescribed is a non-DOT specification fiber reinforced plastic (FRP) full composite (FC) aluminum cylinder made in conformance with the following:

(1) BAC Technology Ltd. design drawings 2650 107 2 dated 5/7/99, 2650 107 1 dated 10/14/98, 2650 650 2 dated 10/14/98, and 2650 650 1 dated 7/29/98, and the report of Design Qualification Tests contained on file with the Office of Hazardous Materials Exemptions and Approvals (OHMEA),

(2) BAC Technology Composite Cylinder Design and Manufacturing Procedure (CCDMP) dated 8/29/99, and

(3) DOT FRP-1 Standard, Revision 2, dated February 15, 1987, (§ 178.AA) contained in Appendix A of this exemption, except as follows:

§ 178.AA-2      Type, size and service pressure.

Type 3FC cylinder consisting of resin impregnated continuous filament windings in helical and circumferential directions over a seamless aluminum liner made in compliance with § 178.AA-6; not over 200 pounds water capacity; and a service pressure of at least 900 psi but not greater than 5000 psi.

§ 178.AA-4      Duties of the Inspector.

(a) Verify conformance to the requirements in this exemption and to DOT FRP-1 Standard Revision 2, dated February 15, 1987.

(b) Verify conformance of aluminum liner with § 178.AA-6. Verify conformance of the filament and resin system components with the requirements specified in § 178.AA-5 of this exemption.

(c) thru (g)    \*   \*   \*

§ 178.AA-5      Authorized Materials and Identification of materials.

(a) Aluminum liner must be 6061 alloy of T6 temper.

(b) Filament material must be Kevlar 49™ or Aramid equivalent. The filaments must be tested in accordance with ASTM-D2343-67(85) for strand strength and must have strand strength of 400,000 psi minimum.

For roving denier determination, the filament material must be tested in accordance with ASTM D3317-74 and must be of at least 90% of the specified nominal value for the rovings. A manufacturer's certified test results for the rovings used in production may be used in lieu of testing.

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(c) thru (e) \* \* \*

b. MARKING: Each cylinder must be marked as prescribed in § 178.AA-15 except as follows:

§ 178.AA-15(b) Required markings are as follows:

\* \* \*

Add (6) Rejection elastic expansion (REE) marking in cubic centimeters. The REE for each design type cylinder is obtained as follows:

1. Perform hydrostatic testing on a lot of cylinders and record elastic expansion (EE) of each cylinder.
2. Find the mean value of the EE for all cylinders tested in item 1.
3. Mark each cylinder with REE which is equal to 10% above the mean value obtained in item 2. The REE marking must follow the date of test.

(c) thru (d) \* \* \*

c. REQUALIFICATION:

(1) Each cylinder must be reinspected and hydrostatically retested at least every five years in a water jacket suitable for the determination of the expansion of the cylinder. The hydrostatic test must be conducted in accordance with the procedures in § 173.34(e)(4) except that the test pressure must be maintained for a minimum of 60 seconds and as much longer as may be necessary to ensure stable volumetric expansion. The elastic and total volumetric expansions must be determined. Reheat treatment or repair of rejected cylinders is not authorized.

(2) Retest dates must be stamped on the exposed metallic surface of the cylinder neck or marked on a label securely affixed to the cylinder and overcoated with epoxy near the original test date.

(3) When a hydrostatic retest is repeated as authorized by § 173.34(e)(4)(v), only two such retests are permitted.

(4) A cylinder must be condemned if the elastic expansion exceeds the marked rejection elastic expansion.

(5) Each time a cylinder is retested, it must be visually inspected internally and externally in accordance with the terms of CGA Pamphlet C-6.1 and C-6.2. The cylinder must be approved, rejected, or condemned according to the criteria set forth in the applicable CGA pamphlet.

(6) Persons who perform inspection and testing of cylinders subject to this exemption must comply with § 173.34(e)(2) and with all the terms and conditions of this exemption. The marking of the retester's symbol on the cylinders certifies compliance with all of the terms and conditions of this exemption.

d. OPERATIONAL CONTROLS:

(1) Cylinders may not be used for underwater breathing purposes.

(2) Cylinders used in oxygen service must conform with §§ 173.302(a)(5)(i) through (a)(5)(iv).

(3) A cylinder that has been subjected to fire may not be returned to service.

(4) Transportation of flammable gases is not authorized aboard aircraft or cargo vessel.

(5) Cylinders must be packaged in accordance with § 173.301(k).

(6) Cylinder service life may not exceed 15 years from the date of manufacture as marked on the cylinder. The in-service testing reports from BAC's Service Life Cycle Program must be submitted to the OHMEA for review.

(7) Filling requirements are subject to all terms contained in § 173.302 for 3AL specification cylinders.

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8. SPECIAL PROVISIONS:

a. In accordance with the provisions of Paragraph (b) of § 173.22a, persons may use the packaging authorized by this exemption for the transportation of the hazardous materials specified in paragraph 6, only in conformance with the terms of this exemption.

b. A person who is not a holder of this exemption, but receives a package covered by this exemption, may reoffer it for transportation provided no modifications or changes are made to the package and it is offered for transportation in conformance with this exemption and the HMR.

c. A current copy of this exemption must be maintained at each facility where the package is offered or reoffered for transportation.

d. Each packaging manufactured under the authority of this exemption must be either (1) marked with the name of the manufacturer and location (city and state) of the facility at which it is manufactured or (2) marked with a registration symbol designated for a specific manufacturing facility.

e. A current copy of this exemption must be maintained at each facility where the package is manufactured under this exemption. It must be made available to a DOT representative upon request.

f. The cylinders described in this exemption are authorized only for normal transportation as an article of commerce i.e., the movement of hazardous materials packages from consignor to consignee.

9. MODES OF TRANSPORTATION AUTHORIZED: Motor vehicle, rail freight, cargo vessel, passenger-carrying aircraft, and cargo only aircraft.

10. MODAL REQUIREMENTS:

a. A current copy of this exemption must be carried aboard each cargo vessel or aircraft used to transport packages covered by this exemption.

b. The shipper must furnish a current copy of this exemption to the air carrier before or at the time the shipment is tendered.



c. Transportation of flammable gases is not authorized aboard aircraft or cargo vessel.

11. COMPLIANCE: Failure by a person to comply with any of the following may result in suspension or revocation of this exemption and penalties prescribed by the Federal hazardous materials transportation law, 49 U.S.C. 5101 et seq:

- o All terms and conditions prescribed in this exemption and the Hazardous Materials Regulations, Parts 171-180.
- o Registration required by § 107.601 et seq., when applicable.

Each "Hazmat employee", as defined in § 171.8, who performs a function subject to this exemption must receive training on the requirements and conditions of this exemption in addition to the training required by §§ 172.700 through 172.704.

No person may use or apply this exemption, including display of its number, when this exemption has expired or is otherwise no longer in effect.

12. REPORTING REQUIREMENTS: The carrier is required to report any incident involving loss of packaging contents or packaging failure to the Associate Administrator for Hazardous Materials Safety (AAHMS) as soon as practicable. (Sections 171.15 and 171.16 apply to any activity undertaken under the authority of this exemption.) In addition, the holder(s) of this exemption must also inform the AAHMS, in writing, as soon as practicable of any incidents involving the package and shipments made under this exemption.

Issued in Washington, D.C.



Robert A. McGuire  
Associate Administrator for  
Hazardous Materials Safety

AUG 18 2000

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(DATE)

Address all inquiries to: Associate Administrator for Hazardous Materials Safety, Research and Special Programs Administration, Department of Transportation, Washington, D.C. 20590.  
Attention: DHM-31.

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The original of this exemption is on file at the above office. Photo reproductions and legible reductions of this exemption are permitted. Any alteration of this exemption is prohibited.

Copies of exemptions may be obtained from the AAHMS, U.S. Department of Transportation, 400 7th Street, S.W., Washington, DC 20590-0001, Attention: Records Center, 202-366-5046.

PO: cwf